Final Progress Report

for

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directed by

Allan M. Krall
Assistant Professor of Mathematics
The Pennsylvania State University
University Park, Pennsylvania 16802

The project "Stabilization for Differential Systems" was to

1. Write a computer program for the root locus method.

2. Write a computer program for the time-lag root locus method.

3. Examine systems with distributed time-lag in order to find stability criterion and to determine when such systems arise.

4. Examine various nonlinear systems in order to find a mathematical foundation for them.

5. Assemble various stability techniques into one place to make them more readily available.

We have accomplished:

1 and 2. A computer program for constructing both ordinary and time-lag root locus diagrams has been written and is being released as a technical report through NASA. We are also in the process of submitting a much shorter version to one of the journals on control in order to reach a wider audience. This program should greatly improve the useability of the root locus method as a stability criterion. It will provide the only really practical stability technique for time-lag systems.

3. We have a stability technique for systems whose characteristic equation is of the form $[z^n + az^{n-1} + \ldots] - Ke^{i\theta} e^{-\sqrt{\tau z}} [z^m + bz^{m-1} + \ldots] = 0$, but have not yet found a suitable application.

4. We have derived a general stability criterion which is applicable to systems with certain nonlinearities such as dead zones and saturation as well as linear systems. It has been released as "A General Stability Criterion for Feedback Systems," NASA-CR68544.

5. Various stability techniques; applicable to linear systems, have been gathered together as "Stability Techniques for Continuous Linear Systems." Both Academic Press and Gordon and Breach have expressed an interest in the manuscript. Gordon and Breach has made a firm commitment to publish it; Academic Press has not. The manuscript will probably be published by Gordon and Breach.

In addition, an article entitled "On the Michailov Criterion for Exponential Polynomials," will shortly appear in the S.I.A.M. Review. Four other articles written by the director concerning differential equations have also appeared in various mathematical journals (including Doklady Akademii Nauk) during the past year.

Allan M. Krall